



12DD 44 – I (08)

**B.Sc. I Semester Degree Examination, Nov./Dec. 2012**  
**PHYSICS**

**Paper – 1.1 : Mechanics and Properties of Matter**

Time: 3 Hours

Max. Marks: 80

- Instructions :** 1) *Section I is compulsory.*  
2) *Answer any four questions from Section II and any four questions from Section III.*

**SECTION – I**

1. Answer **any twelve** of the following :

(12×1=12)

A) Choose the correct answer :

- i) In non-inertial frame of reference
  - a) Newton's third law is valid
  - b) Newton's laws and Lorentz transformations are valid
  - c) Newton's I and II law are valid
  - d) None of the above
- ii) In an inelastic collision
  - a) Momentum is conserved
  - b) Energy is conserved
  - c) Both a) and b)
  - d) None of these
- iii) The bar pendulum is used to find
  - a) The value of 'g'
  - b) Radius of gyration
  - c) Moment of inertia of the bar
  - d) All the above
- iv) The sucking of all in a wick of a stove is due to
  - a) Viscosity
  - b) Adhesion
  - c) Gravitation
  - d) Surface tension

B) Fill in the blanks :

- i) Length is \_\_\_\_\_ under Galilean transformation.
- ii) Centrifugal force is \_\_\_\_\_ force.
- iii) For an elliptical orbit, the eccentricity \_\_\_\_\_
- iv) The angle of contact for mercury glass is \_\_\_\_\_

P.T.O.



C) State **true** or **false** :

- i) The moment of inertia of a body depends upon angular velocity of the body.
- ii) A spiral spring is stretched by a weight, attached to it, the strain will be shear.
- iii) All the planets move in an elliptical path having the sun as one focus.

D) Answer the following in **one** or **two** sentences :

- i) Define frames of reference.
- ii) Define centrifugal force.
- iii) Define surface energy.
- iv) What is stream line motion ?

#### SECTION – II

2. Show that position is invariant to Galilean transformation. (4×4=16)
3. Derive an expression for closed orbit.
4. What is compound pendulum ? Show that centre of oscillation and centre of suspension are interchangeable.
5. State and prove Kepler's III law of planetary motion.
6. Obtain an expression for the work done per unit volume Bulk Strain.
7. What is gravitational potential ? Derive an expression for gravitational potential.

#### SECTION – III

8. a) Derive Galilean transformation equations and hence prove law of conservation of momentum and law of conservation of energy are invariant to Galilean transformation.
- b) A rocket of mass 500 kg is fired, vertically upwards from a place at a equator with a velocity of  $1500 \text{ ms}^{-1}$ . If the angular velocity of the earth is  $7.3 \times 10^{-5} \text{ rad/s}$ . Calculate Coriolis force acting on it. (9+4=13)





9. a) Obtain an expression for radial and transverse component by velocity and acceleration of a particle executing uniform circular motion.  
b) A body of mass 0.2 kg is rotated at 120 revolutions per minute in a horizontal circle of radius 2 m. Calculate the angular velocity, linear velocity and centripetal force. (9+4)
10. a) What is a rocket? Obtain an expression for velocity of a rocket taking weight into consideration.  
b) A 2 kg man moving with a velocity  $10 \text{ ms}^{-1}$  collides with another body of mass 6 kg moving in opposite direction with a velocity of  $2 \text{ ms}^{-1}$ . During collision they stick together. Find their common velocity. (9+4)
11. a) Obtain an expression for moment of inertia of a circular disc about an axis :  
i) Passing through its centre and perpendicular to its plane.  
ii) About any diameter.  
b) A thin metal ring of radius 0.5 m and mass 0.5 kg starts from rest Q rolls down an inclined plane. Its linear velocity on reaching the foot of the plane is  $5 \text{ ms}^{-1}$ . Calculate the moment of inertia of the ring and the K.E. of rotation at that point. (9+4)
12. a) What is meant by torsional oscillations? Derive an expression for the torsional couple per unit angular twist in the case of wire.  
b) Calculate the young's modulus of the material of a wire of 3 m long and 1 mm radius when the force of 950 N increases its length by 5 mm. (9+4)
13. a) Derive an expression for Poiseuille's formula for the rate of flow of liquid through a capillary tube.  
b) Calculate the mass of the water flowing 10 minutes through a tube of  $0.1 \times 10^{-2} \text{ m}$  in diameter 0.4 m long, if there is a constant pressure head of 0.2 m of water. The coefficient of viscosity of water is 0.00089 SIU.  
[Density of water =  $1000 \text{ kg/m}^3$ ,  $g = 9.8 \text{ ms}^{-2}$ ] (9+4)

B. Fill in the blanks

- i) Length is \_\_\_\_\_ under Galilean transformation.  
ii) Centrifugal force is \_\_\_\_\_ force.  
iii) For an elliptical orbit, the eccentricity \_\_\_\_\_  
iv) The angle of contact for mercury glass is \_\_\_\_\_

